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PRELIMINARY ANALYSIS  
OF  
VHF AND UHF SPECTRUM  
SCENARIOS -- PART III  
(NTSC TABOOS)

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PRELIMINARY ANALYSIS OF VHF & UHF  
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Executive Summary

This document presents an analysis of the data generated by the Broadcasters Caucus of the Advanced Television Systems Committee (ATSC) to assess the potential of implementing a simulcast advanced television service within the existing broadcast bands in the presence of the NTSC taboo restrictions. The work was carried out to support the activities of the Spectrum Utilization and Alternatives Working Party of the Planning Subcommittee of the FCC Advisory Committee on Advanced Television Service (ACATS).

The analysis, presented herein, examines the impact of keeping some or all of the current NTSC taboo mileage restrictions on the availability of ATV spectrum. Specifically, it investigates the impact of retaining both single or multiple taboos\* on the overall availability of ATV spectrum. Also included in the analysis is a study of the impact of modifying the taboo mileage restrictions and allowing exact or near co-location of the taboo channel. The studies are based on a minimum co-channel separation of 160 km (100 miles). Furthermore, emphasis must be placed on the preliminary nature of the studies. No final conclusions can be drawn until the analysis of laboratory studies shows what co-channel separation of ATV-NTSC and ATV-ATV is feasible and whether or not taboo channel separation specifications are required.

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\*The first, second, third, fourth, fifth, seventh, eighth, fourteenth or fifteenth channel removed from (i.e., above and below) the assigned NTSC channel is known as a "taboo" channel. Taboos are generally grouped according to the different interference mechanisms, such as intermodulation, cross modulation, image, IF-beat, etc.

The purpose of this exercise is twofold: The first is to quantify the number of existing assignments that can be accommodated with an additional 6-MHz ATV channel if laboratory testing reveals that it might be necessary to retain some or all of the existing NTSC taboo restrictions. The second, and most important, purpose is to examine a number of different assignment alternatives intended to minimize or completely eliminate the impact of the taboos, thus improving the availability of spectrum for ATV.

Three different scenarios were used to assess the availability of spectrum for ATV. The first scenario applies the taboo separation restrictions to all ATV and NTSC assignments (i.e., the taboo restrictions are applied for both ATV-NTSC and ATV-ATV channel separations). The second applies the taboo separation restrictions only to existing NTSC assignments. In this case, restrictions are applied to ATV-NTSC channel separations but not to ATV-ATV. The third scenario also applies the separation restrictions to existing NTSC assignments as in the second scenario; however, it allows co-location of the taboo channel at the NTSC channel location.

The document contains a number of findings and observations. These could be consolidated into four major findings:

- 1) Full ATV accommodation for existing licensees is not possible if all the NTSC taboos are retained. Using the third taboo scenario described above, only 91% of all existing licensees can be accommodated. Under the first scenario, the percentage decreases to 72%.

- 2) Regardless of which scenario was examined, the picture image taboo ( $n + 15$ ) was determined to achieve the worst accommodation statistics for ATV, while the IF-beat taboos exhibited the best.
- 3) Except for the image taboos ( $n + 14$ ,  $n + 15$ ), the effect of changing the taboo separation restrictions has little impact on the ATV accommodation statistics.
- 4) Allowing exact co-location of the taboo channel improves the ATV accommodation statistics. Near co-location of the taboo channels provides moderate improvement to the ATV accommodation statistics in the case of the adjacent and image taboos; however, near co-location significantly improves the statistics for all other taboos.

PRELIMINARY ANALYSIS OF VHF & UHF  
SPECTRUM SCENARIOS -- PART III  
(NTSC TABOOS)

I. INTRODUCTION

Working Party 3, the Spectrum Utilization and Alternative Working Party of the FCC Advisory Planning Subcommittee, was tasked with examining the various spectrum alternatives for accommodating an advanced television service within the existing VHF and UHF television allocations. For the past three years, the broadcast industry -- with the help and cooperation of the FCC -- has actively supported the activities of the Working Party by conducting studies to assess the availability of spectrum for a broadcast ATV service. This document, a follow-up of the earlier work,<sup>1/2/</sup> examines the availability of spectrum for ATV in the event testing reveals that some or all of the existing NTSC taboo separation restrictions will have to be retained either in their present or modified form. The data and analyses presented in this report were funded by the Broadcasters Caucus of the Advanced Television Systems Committee (ATSC).

The purpose of this exercise is twofold: The first is to quantify the number of ATV assignments that can be accommodated within the VHF/UHF allocations under a number of different scenarios and assumptions. This information is useful in helping spectrum managers and system developers better understand the capability of the current broadcast spectrum to accommodate all

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<sup>1/</sup> See Appendix B. "Preliminary Analysis of VHF & UHF Spectrum -- Part I (Augmentation and Simulcast)", July 1988.

<sup>2/</sup> See Appendix C. "Preliminary Analysis of VHF & UHF Spectrum -- Part II (Repacking)", September 1989.

existing licensees. For example, by ranking the various taboos (single and/or multiple) strictly from an ATV accommodation/spectrum efficiency perspective, both spectrum managers and ATV system developers can get a clear sense of the relative impact of the different taboos. This information is particularly useful to ATV system proponents in that it allows them to tailor the design of their systems to better match the spectrum assignment constraints.

The second purpose of this exercise is to investigate a number of different assignment alternatives intended to minimize or eliminate the impact of the various taboos, thus improving the accommodation statistics for ATV. This information is also useful in helping spectrum managers determine the extent to which the effect of taboos could be minimized or completely eliminated through the allotment/assignment process.

The report examines three different spectrum scenarios. The first scenario -- referred to herein as the "ATV/NTSC scenario" -- examines the availability of ATV spectrum while keeping or modifying some or all of the taboo restrictions for separations of ATV-NTSC and ATV-ATV assignments. The second scenario -- referred to herein as the "NTSC scenario" -- examines the availability of ATV spectrum by applying the taboo separation restrictions only from the new ATV assignments to the existing NTSC assignments. The third and final scenario -- referred to herein as the "NTSC/Co-location scenario" -- examines the availability of ATV spectrum if the taboo separation restrictions from the new ATV assignments to the existing NTSC assignments are maintained; however, it allows exact co-location of the ATV station using the taboo channel.

## II. BACKGROUND

"Taboo" is a term applied to those interference effects (other than co-channel) which must be taken into account to provide relatively interference-free NTSC television reception. They include such interference mechanisms as cross- and inter-modulation, sound and picture image, oscillator radiation, and intermediate frequency beat. (Adjacent channel is also sometimes referred to as a "taboo".) The Federal Communications Commission has protected VHF channels from adjacent interference and UHF channels from the whole panoply of interference sources by requiring minimum separations between the protected station and other stations using channels critical to the taboos. These minimum separation distances were established to prevent interference to NTSC television receivers. Table 1 lists the various taboo channels and the corresponding minimum separation distances required by the FCC rules.

The structure of the NTSC signal -- with its distinct picture and sound carriers -- is the basis for these interference sources. However, the extent to which these interference sources degrade television reception largely depends on the design of the NTSC receiver and its ability to reject these interference effects. Unfortunately, the ability of NTSC receivers to reject these interfering signals varies greatly among receivers, and for the past 40 years little progress has been made to improve the interference immunities of these receivers.<sup>3/</sup> Technologies are currently available to virtually eliminate, most, if not all, of these taboo interference effects; however, consumer equipment

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<sup>3/</sup> One exception is the oscillator radiation taboo ( $n + 7$ ), where improvements in UHF tuner design has essentially eliminated this type of interference.

manufacturers have little incentive to implement them. Appendix A contains a detailed description of these interference mechanisms.

TABLE 1

FCC NTSC Taboo Channel Restrictions

<u>TABOO CHANNEL*</u>	<u>MINIMUM SEPARATION DISTANCE (KM)</u>
<u>Adjacent</u>	
n + 1, n - 1 (VHF)	95.7
n + 1, n - 1 (UHF)	87.7

Following Apply to UHF Only

Inter/Cross-modulation

n + 2, 3, 4 and 5	31.4
n - 2, 3, 4 and 5	31.4
n + 2 and n + 4	31.4
n - 2 and n - 4	31.4

IF/Half IF-Beat

n + 7 and n + 8	31.4
n - 7 and n - 8	31.4

Oscillator Radiation\*\*

n + 7	95.7
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Sound/Picture Image

n + 14	95.7
n + 15	119.9

\*Here "n" is the desired channel. The table entries represent the number of channels above or below the desired channel.

\*\*The oscillator radiation taboo will not be considered in this analysis. Improvements in UHF tuner design have essentially eliminated the need to protect this taboo.



In the summers of 1988 and 1989, the Association for Maximum Service Television (MSTV), formerly MST, conducted a number of studies to examine the effect of co-channel and adjacent-channel separations on the availability of spectrum for ATV.<sup>4/</sup> Those studies demonstrated that providing each existing NTSC station with additional spectrum for an augmentation or simulcast channel for ATV transmission would require an ATV system that is both benign and robust relative to existing NTSC signals. That is the ATV system must exhibit low potential for causing interference to existing NTSC reception and should be relatively immune to interference from NTSC stations. These studies further concluded that a co-channel spacing on the order of 160 km (100 miles) would be required to achieve full, or near full, accommodation of all existing NTSC stations.

Although these previously reported studies showed that sufficient spectrum could be made available within the present VHF/UHF allocations to accommodate all existing stations, there is no certainty at this point that the NTSC taboos will not ultimately have to be taken into account. Recognizing, however, that the actual need for taboo protection cannot be determined until the rf performance of ATV systems is tested, it was decided to undertake computer studies to determine the impact on spectrum availability if, in fact, one or more taboos would have to be retained.

### III. ANALYSIS

Prior to presenting the analysis, a few comments and observations are in order. First, it is important to recognize that the work presented herein is preliminary and should be treated

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<sup>4/</sup> See page 1, footnotes 1 and 2.

as such, even though all the scenarios were investigated using the most recent FCC broadcast database, including pending applications, and provisions were made to protect existing Canadian and Mexican NTSC assignments. Final results cannot be produced until the laboratory tests are completed and certain threshold issues, such as the use of vacant allotments, exact location of ATV assignments, etc., are decided by the Commission. Second, it is important to emphasize that all the findings presented in this document assume that the method used furnishes optimal or near-optimal results. While there is no easy way to test this premise, based on three years experience in using this methodology, it is believed that this assumption is valid. Finally, it is also important to emphasize that the statistics presented below are nationwide statistics. These statistics are generally representative of most areas of the country. However, in some areas, particularly in areas of high concentration of NTSC stations, the national statistics may present a more optimistic ATV accommodation assessment than the actual statistics for these areas. It is particularly important to note that the impact of retaining the NTSC taboos is mainly felt in the most congested regions of the country, such as the Northeast corridor.

#### 1. Description of Methodology

Given the absence of actual taboo interference data for ATV systems, a system-independent method was developed to carry out the analysis. Specifically, the method uses minimum separation distances to determine the number of existing TV stations that can be accommodated with an ATV simulcast channel under different taboo assumptions. A detailed description of the methodology and the options used for this analysis are described in section 2 below.

Described below are the three spectrum scenarios selected to assess the taboo impacts. All three scenarios are being investigated using a single co-channel spacing of 160 km. This spacing was selected since previous work had indicated that co-channel spacing on the order of 160 km would be required for full, or nearly full, ATV accommodation of all existing stations. All results obtained in this study will be compared against the accommodation statistics for the co-channel only case. The co-channel only case will be referred herein as the "baseline run".

a) ATV/NTSC Scenario

The ATV/NTSC scenario examines the impact of both individual and multiple taboos on the availability of ATV spectrum by applying the taboo separation restrictions equally to both existing NTSC stations and newly assigned ATV channels. This scenario, the most restrictive of the three scenarios, is based on the supposition that the spectral composition and/or interference effects of the ATV signal are similar to NTSC and that the interference immunities of the new ATV receivers are comparable to the current NTSC sets.

b) NTSC Scenario

The NTSC scenario examines the availability of ATV spectrum by applying the taboo separation restrictions for new ATV channels only to existing NTSC assignments. This scenario is based on the supposition that the spectral composition of the ATV systems will be entirely different from NTSC, and may not even include any carriers, and hence be unable to generate some NTSC interference-type conditions. It also assumes that

the new ATV receivers will incorporate new and improved design and manufacturing tolerances that will virtually eliminate these interference effects for the new ATV service.

c) NTSC/Co-location Scenario

The third scenario examines the availability of ATV spectrum by applying the taboo separation restrictions only to existing NTSC assignments as in the NTSC scenario; however, it allows for exact co-location of the taboo channel with the associated NTSC channel. This scenario -- the least restrictive of the three scenarios -- is based on the same technical assumptions as the previous one, but also takes advantage of the known characteristics of the NTSC taboos and tries to minimize these interference effects by assigning the undesired taboo channel at the same site as the desired NTSC channel.

The taboo analysis is by far the most ambitious and complex spectrum study undertaken by the broadcast industry to date. To conduct the full range of analysis of the taboo impacts required extensive software modifications of the FCC ATV computer assignment model and the review and analysis of hundreds (approximately 600) of computer runs. More specifically, it requires the evaluation of at least sixteen individual taboo channels (fourteen if the adjacent channels are excluded) and half a dozen multiple taboo combinations. Furthermore, since the new ATV systems may require different (less or more stringent) taboo protection, additional analyses are required to determine the impact of varying (increasing or reducing) the taboo separation restrictions on the overall availability of spectrum for ATV.

Also, since it appears that co-location of the ATV channel can indeed be a viable option in minimizing taboo interference effects for both ATV and NTSC, additional analyses were required to examine whether near co-location of the taboo channel, within 5 to 10 miles (8 to 16 km) from the NTSC transmitter, could significantly improve the ATV accommodation statistics.

## 2. Modification of the ATV Assignment Model

The ATV assignment model uses a heuristic approach to determine the best ATV accommodation statistics for each scenario. This is accomplished by first ordering the existing stations according to the apparent difficulty of finding a channel for them and using a number of different allotment algorithms that attempt to find the largest number of stations that can be accommodated nationwide, i.e., the best solution.

The FCC version of the model was based on fixed criteria to ascertain the availability of spectrum for ATV. The output of the model is in the form of different tables showing the total number of VHF stations and the total number of UHF stations for which ATV assignments were feasible; the total number of both VHF and UHF stations assigned ATV spectrum; and the percentage of the total number of stations considered for which spectrum was determined to be available. Each table provided the results based on 15 different co-channel separations.

The FCC version of the model did not attempt to consider the UHF taboo restrictions when making ATV assignments. Instead, it only used a single first adjacent channel restriction for both VHF and UHF. The program allowed a station to be assigned any channel except its own as long as such an assignment was not in conflict with another existing NTSC assignment. In addition,

the use of a co-located adjacent channel was limited to the station's own adjacent channels. Even if a second station is located at the same site, the first station's adjacent channels were not considered to be candidates for use by the second station.

A series of modifications and additions have been made to the FCC version of the model. Instead of the fixed criteria (the 15 different co-channel and an adjacent channel separations) used by the FCC model which produced multiple results, the modified program now requests the user to specify the criteria to be used and a single set of results is produced based on the criteria selected. In addition, the output has been modified to list the criteria used, provide the number of VHF and UHF stations for which spectrum was found and to list the total number of stations for which spectrum was sought. The results also list each station considered for assignment, giving the city name, geographic coordinates, the existing NTSC channel and, if found, the new channel to be used for ATV simulcasting. The program has also been modified to apply constraints in all cases to not allow a station to be assigned a channel that would be in conflict with its existing channel.

The user has also been provided with several additional options that can be considered in the analysis. These options include:

- a) The ability to select the minimum co-channel separation distance. The default is 160 km. (The minimum co-channel separation distance applies to both ATV-ATV and ATV-NTSC spacings.)

- b) The ability to use different first adjacent channel spacing for VHF and UHF as well as the ability to allow for use of an adjacent channel co-located with any station or within a user specified distance of any station. Both VHF and UHF first adjacent channel restrictions default to 87.7 km.
- c) The ability to consider any or all of the UHF taboos when making ATV assignments.
- d) The ability to adjust any of the taboo distances or use the default distances in Table 1.
- e) The ability to permit the use of a co-located taboo channel or a taboo channel within a distance selected by the user.
- f) The ability to select the image, IF-Beat and Inter/Cross modulation taboo channels to be used in the analysis. The default is to apply all the taboo channel restrictions, including the adjacent channels.
- g) The ability also to apply the adjacent channel constraints as well as any of the UHF taboo separation constraints with respect to the NTSC and/or ATV assignments. The default is to apply the constraints only with respect to existing NTSC assignments.

### III. RESULTS

The results are grouped into three categories. The first category examines the impact of varying the taboo mileage restrictions for all individual taboos and some multiple taboo combinations. The second category compares all three scenarios using the NTSC taboo separation restrictions in Table 1. The third and last category examines the effect of near co-location on the availability of spectrum.

#### 1. Effect of Varying the Taboo Separation Restrictions

##### a) ATV/NTSC Scenario

Table 1-D in Appendix D presents the number of VHF and UHF stations for which ATV spectrum was found at different separation distances for all the individual taboos and a number of multiple taboos. Also included are the total number of stations accommodated and the number of stations that can not be accommodated relative to the baseline run (160-km co-channel spacing with no taboo restrictions).

A review of the data reveals the following:

- 1) Reducing the inter/cross modulation and IF-related taboo separation distances has little effect on the ATV accommodation statistics. On the other hand, increasing the taboo separation distances shows a marked decrease in the ATV accommodation statistics. Except for the  $n + 2$ ,  $n + 4$  and the  $n - 2$ ,  $n - 4$  taboos, and for separation distances less than or equal to NTSC, the impact is minimal (loss of 5



or fewer channels). However, it is important to note that these losses occur mainly in the major markets.

- 2) Reducing the picture and sound image taboo separation distances slightly improves the ATV accommodation statistics. The impact of the image taboos on the availability of spectrum for ATV is considerably greater than that of the inter/cross modulation or the IF-related taboos.

b) NTSC Scenario

Table 2-D in Appendix D presents the ATV accommodation statistics for the NTSC scenario. The data reveal the following:

- 1) Reducing the inter/cross modulation and the IF-related taboo separation distances has no effect on the ATV accommodation statistics. Increasing those taboo separation distances has a negligible effect on the ATV accommodation statistics.
- 2) Reducing the picture and sound image taboo separation distances has a small effect on the ATV accommodation statistics. Here again, the impact of the image taboos on the ATV accommodation statistics is considerably greater than that of the inter/cross modulation

or the IF-related taboos for the same scenario, but the impact is slightly less than for the previous scenario.

c) NTSC/Co-location Scenario

Table 3-D in appendix D presents the ATV accommodation statistics for the NTSC/Co-location scenario. A review of the data reveals the following:

- 1) Changing (reducing or increasing) the inter/cross modulation and IF-related taboo separation distances has virtually no impact on the ATV accommodation statistics.
- 2) For distances less than or equal to NTSC separation requirements, the loss of ATV assignments resulting from varying the sound and image taboo separation restrictions can be characterized as minimal (loss of 5 or fewer channels). Here again, it is important to note that these losses occur mainly in the major markets.

All in all, it can be concluded that regardless of which scenario was examined, the image taboos -- particularly the picture image taboo ( $n + 15$ ) -- achieved the worst ATV accommodation statistics. The IF-related taboos exhibited the best statistics, followed closely by the inter/cross modulation taboos.

## 2. Comparison of Scenarios

To compare the performance and/or highlight the differences among the three scenarios, a side-by side tabulation of the taboo data using a single separation distance is necessary. Using the existing minimum NTSC separation distances (listed in Table 1), Table 2 presents statistics relating to the number of ATV assignments lost relative to the baseline run for both individual and multiple inter/cross modulation taboos.

A close examination of the statistics in Table 2 reveals that full ATV accommodation is achievable for all single and some multiple inter/cross modulation taboos in the case of the NTSC/Co-location scenario. Also, full ATV accommodation is achievable for selected individual taboos under the NTSC Scenario. Full ATV accommodation is not possible under the ATV/NTSC scenario.

**TABLE 2**

### INTER/CROSS MODULATION TABOOS

<u>TABOO CHANNEL*</u>	<u>ATV/NTSC SCENARIO**</u>	<u>NTSC SCENARIO**</u>	<u>NTSC/CO-LOCATION SCENARIO**</u>
n + 2	3	0	0
n - 2	3	1	0
n + 3	5	1	0
n - 3	5	3	0
n + 4	4	0	0
n - 4	4	1	0
n + 5	4	0	0
n - 5	4	0	0
n + 2, n + 4	19	1	0
n - 2, n - 4	19	1	0
n ± 2,3,4,5	70	50	11

\*Minimum separation distances listed in Table 1 were used.

\*\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

Table 3 presents data relating to the number of ATV assignments lost relative to the baseline run for all the IF-related taboos. Here again, It is possible to achieve full ATV accommodation for both the NTSC and NTSC/Co-location scenarios for all individual IF-related taboos. Full ATV accommodation is not possible under the ATV/NTSC scenario; however, the impact is somewhat less than in the case of the inter/cross modulation taboos.

**TABLE 3****IF-RELATED TABOOS**

<u>TABOO CHANNEL*</u>	<u>ATV/NTSC SCENARIO**</u>	<u>NTSC SCENARIO**</u>	<u>NTSC/CO-LOCATION SCENARIO**</u>
n + 7	2	0	0
n - 7	2	0	0
n + 8	2	0	0
n - 8	2	0	0
n + 4	4	0	0
n + 4, $\pm$ 7 & 8	33	11	1

\*Minimum separation distances listed in Table 1 were used.

\*\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

Table 4 presents data relating to adjacent and image taboos. The data reveal that full ATV accommodation is not possible for any of the three scenarios, However, the impact of protecting individual adjacent or image taboo channels could be characterized as small for the NTSC/Co-location scenario.

TABLE 4  
 ADJACENT & IMAGE TABOOS

<u>TABOO</u> <u>CHANNEL*</u>	<u>ATV/NTSC</u> <u>SCENARIO**</u>	<u>NTSC</u> <u>SCENARIO**</u>	<u>NTSC/CO-LOCATION</u> <u>SCENARIO**</u>
n + 1	63	20	3
n - 1	60	15	1
n ± 1	93	63	30
n + 14	35	5	3
n + 15	99	30	7
n ± 1, + 14, + 15	338	156	75

\*Minimum separation distances listed in Table 1 were used.

\*\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

Lastly, Table 5 presents data relating to the number of ATV assignments lost for a number of multiple taboo combinations and all NTSC taboos. A close examination of the data reveals that if we elect to protect all the NTSC taboos, approximately 9% of all existing stations cannot be accommodated under the NTSC/Co-location scenario. The value increases to 28% if we elect to protect both the ATV and NTSC assignments. Here again, it is important to note that these losses occur mainly in the most congested markets. The data also show that the impact of the IF-related and inter/cross modulation taboos is relatively small.

TABLE 5  
MULTIPLE TABOOS

<u>TABOO CHANNEL*</u>	<u>ATV/NTSC SCENARIO**</u>	<u>NTSC SCENARIO**</u>	<u>NTSC/CO-LOCATION SCENARIO**</u>
n $\pm$ 1	93	63	30
n $\pm$ 1,14,15	338	156	75
n + 2,3,4,5	70	50	3
n + 4, $\pm$ 7 & 8	19	11	1
n $\pm$ 2,3,4,5,7,8	135	98	11
n $\pm$ 1,2,3,4,5,7, 8, + 14,15	483	304	153

\*Minimum separation distances listed in Table 1 were used.

\*\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

All in all, it can be concluded that full ATV accommodation is not possible if all the NTSC taboos are retained. However, it may be possible to retain some or all of the IF-related taboos and achieve a full, or near full, ATV accommodation.

### 3. Effect of Near Co-location

Two scenarios, the NTSC/ATV and NTSC/Co-location scenarios, were used to examine the effect of near (as opposed to exact) co-location on the availability of ATV spectrum. Specifically, the taboo channels were allowed to be co-located within 0.0 km, 8.0 km and 16.0 km of the desired NTSC station. Tables 6 and 7 present data relating to the number of ATV assignments lost relative to the baseline run for the image and adjacent channel taboos, and the intermodulation and IF-related taboos respectively.

TABLE 6  
CO-LOCATION OF ADJACENT AND IMAGE TABOOS

<u>TABOO CHANNEL</u>	<u>SEPARATION DISTANCE (KM)</u>	<u>NTSC/CO-LOCATION SCENARIO*</u>	<u>NTSC/ATV SCENARIO*</u>
<u>Adjacent</u>			
n + 1	0.0 and > 87.7	3	47
n + 1	< 8.0 and > 87.7	3	42
n + 1	< 16.0 and > 87.7	2	37
n - 1	0.0 and > 87.7	1	47
n - 1	< 8.0 and > 87.7	1	42
n - 1	< 16.0 and > 87.7	0	37
<u>Image</u>			
n + 14	0.0 and > 95.7	3	24
n + 14	< 8.0 and > 95.7	3	19
n + 14	< 16.0 and > 95.7	0	17
n + 15	0.0 and > 119.9	7	55
n + 15	< 8.0 and > 119.9	7	44
n + 15	< 16.0 and > 119.9	5	42
<u>Adj &amp; Image</u>			
n+1,+14,+15	0.0 and > 87.7, 95.7, 119.9	75	247
n+1,+14,+15	< 8.0 and > 87.7, 95.7, 119.9	60	221
n+1,+14,+15	< 16.0 and > 87.7, 95.7, 119.9	57	217

\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

TABLE 7  
CO-LOCATION OF INTER/CROSS MODULATION  
AND IF-BEAT TABOOS

<u>TABOO CHANNEL</u>	<u>SEPARATION DISTANCE (KM)</u>	<u>NTSC/CO-LOCATION SCENARIO*</u>	<u>NTSC/ATV SCENARIO*</u>
<u>Inter/Cross Modulation</u>			
n + 2, 3, 4, 5	0.0 and > 31.4	3	19
n + 2, 3, 4, 5	< 8.0 and > 31.4	0	3
2, 3, 4, 5	< 16.0 and > 31.4	0	2
<u>IF-Beat</u>			
n + 4, 7, 8	0.0 and > 31.4	0	6
n + 4, 7, 8	< 8.0 and > 31.4	0	1
n + 4, 7, 8	< 16.0 and > 31.4	0	1
<u>IF-Beat &amp; Inter /Cross modulation</u>			
n + 2,3,4,5,7,8	0.0 and > 31.4	12	49
n + 2,3,4,5,7,8	< 8.0 and > 31.4	1	8
n + 2,3,4,5,7,8	< 16.0 and > 31.4	0	1

\*The value denotes the number of ATV assignments lost relative to assignment based only on co-channel separations at 160 km and without other constraints.

A review of the statistics in Table 6 reveals that the impact of allowing near co-location of the taboo channels did not significantly improve the ATV accommodation statistics for adjacent and image taboos. Table 7 shows a marked improvement in the statistics for the inter/cross modulation and IF-beat taboos.



#### IV. CONCLUSIONS

The study reported herein shows that a need to retain the current NTSC adjacent channel and taboo separation restrictions for new ATV simulcast assignments would seriously restrict the availability of such assignments even if co-channel separations can be as little as 160 km (100 miles). Under the least restrictive scenario, 9% of presently authorized stations would not have available companion ATV assignments. Compounding the problem is the fact that the losses would occur in the most congested television markets. Consequently, in those markets, the accommodation statistics would be far worse than for the country as a whole.

On the other hand, the prospects for ATV simulcast accommodation are not likely to be as bleak as the foregoing paragraph suggests. Little likelihood exists that full adjacent channel and taboo protection restrictions will be required by the selected ATV system. The absence of carriers in most ATV systems and improved receivers may eliminate the need for taboo protection and, at least allow co-located adjacent channels. If only a single taboo restriction must still be enforced, little impact on accommodation statistics would result. Image protection (particularly video) imposes the greatest restriction because it requires the greatest separation, but if combination with other separation restraints is not necessary, the impact would not be severe.